

## CLAIMS

What is claimed is:

1     1.     A method of processing a network device operating system operation, the method  
2           comprising the computer-implemented steps of:  
3           receiving the network device operating system operation and associated data within  
4                    an Extensible Markup Language (XML) document;  
5           parsing the XML document to identify the network device operating system  
6                    operation;  
7           selecting one of several network device operating system components that can  
8                    process the identified network device operating system operation;  
9           preparing the associated data for use by the selected one of several network device  
10                   operating system components; and  
11          providing the identified network device operating system operation and the prepared  
12                   data in a callback to the selected one of the several network device operating  
13                   system components.

1     2.     The method of Claim 1, further comprising the steps of:  
2           receiving responsive data from the selected one of the several network device  
3                    operating system components;  
4           creating a responsive XML document that contains the responsive data in XML  
5                    format; and  
6           sending the responsive XML document to a network management application.

1     3.     The method of Claim 1, wherein the XML document is received within a transport  
2           protocol message that conforms to one of several transport protocols, and further

3 comprising the step of extracting the XML document from the transport protocol  
4 message.

1 4. The method of Claim 1, further comprising the steps of:  
2 at the selected one of the several network device operating system components,  
3 processing the identified network device operating system operation in  
4 preparation for invoking a function that can perform one or more tasks  
5 associated with the operation; and  
6 invoking the function defined by the network device operating system component that  
7 can perform the one or more tasks associated with the operation.

1 5. The method of Claim 1, wherein the XML document includes data associated with  
2 the network device operating system operation, and wherein the step of processing  
3 the identified network device operating system operation in preparation for invoking  
4 the function comprises:  
5 validating data associated with the network device operating system operation; and  
6 mapping the data to one or more data structures that are associated with the function.

1 6. The method of Claim 1, further comprising the steps of:  
2 receiving, in the XML document, a query from a network management application  
3 about the several network device operation system components that are  
4 supported; and  
5 providing a response to the network management application that identifies one or  
6 more of the several network device operation system components that are  
7 supported.

1 7. The method of Claim 1, further comprising the steps of:

2 receiving, in the XML document, a query from a network management application  
3 about one or more of several objects that are supported by the several  
4 components; and  
5 providing a response to the network management application that identifies one or  
6 more of the objects that are supported.

1 8. The method as recited in Claim 7, further comprising the steps of:  
2 receiving, in the XML document, receiving a query from a network management  
3 application about one or more of several methods that are supported by the  
4 objects; and  
5 providing a response to the network management application that identifies one or  
6 more of the methods that are supported.

1 9. The method as recited in Claim 7, further comprising the steps of:  
2 receiving, in the XML document, a query from a network management application  
3 about one or more of several attributes that are supported by the methods; and  
4 providing a response to the network management application that identifies one or  
5 more of the attributes that are supported.

1 10. The method as recited in Claim 1, further comprising the steps of:  
2 receiving, in the XML document, an invocation by a network management  
3 application of one or more of several methods that are implemented by one or  
4 more objects of the several components; and  
5 invoking the one or more methods through a callback to one or more of the  
6 components.

1 11. A computer-readable medium for processing a network operating system operation  
2 for a network device, comprising:  
3 a plurality of network device operating system components comprising instructions  
4 for performing network device operating system operations;  
5 XML infrastructure logic comprising instructions for receiving the network operating  
6 system operation and associated data within an Extensible Markup Language  
7 (XML) document; and  
8 programmatic agent infrastructure logic comprising instructions for parsing the XML  
9 document to identify the network device operating system operation, selecting  
10 one of several network device operating system components that can process  
11 the identified network device operating system operation, preparing the  
12 associated data for use by the selected one of several network device operating  
13 system components, and providing the identified network device operating  
14 system operation and the prepared data in a callback to the selected one of the  
15 several network device operating system components.

1 12. A computer-readable medium as recited in Claim 11, wherein each of the network  
2 device operating system components comprises:  
3 component XML logic that implements one or more of the callbacks to which the  
4 identified network device operating system operation and the prepared data  
5 are provided by the programmatic agent infrastructure logic;  
6 component API logic that provides an application programming interface for one or  
7 more functions of the network device operating system component.

1 13. A computer-readable medium as recited in Claim 12, wherein the component XML  
2 logic further comprises instructions for data validation of the data associated with the  
3 identified network device operating system operation and for mapping the data to one  
4 or more data structures that are associated with the one or more functions.

1 14. A computer-readable medium carrying one or more sequences of instructions for  
2 processing a network device operating system operation, which instructions, when  
3 executed by one or more processors, cause the one or more processors to perform the  
4 steps of:  
5 receiving the network device operating system operation and associated data within  
6 an Extensible Markup Language (XML) document;  
7 parsing the XML document to identify the network device operating system  
8 operation;  
9 selecting one of several network device operating system components that can  
10 process the identified network device operating system operation;  
11 preparing the associated data for use by the selected one of several network device  
12 operating system components; and  
13 providing the identified network device operating system operation and the prepared  
14 data in a callback to the selected one of the several network device operating  
15 system components.

1 15. A computer-readable medium as recited in Claim 14, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:

4 receiving responsive data from the selected one of the several network device  
5 operating system components;  
6 creating a responsive XML document that contains the responsive data in XML  
7 format; and  
8 sending the responsive XML document to a network management application.

1 16. A computer-readable medium as recited in Claim 14, wherein the XML document is  
2 received within a transport protocol message that conforms to one of several transport  
3 protocols, and further comprising instructions, which when executed by the one or  
4 more processors, cause the one or more processors to perform the step of extracting  
5 the XML document from the transport protocol message.

1 17. A computer-readable medium as recited in Claim 14, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:  
4 at the selected one of the several network device operating system components,  
5 processing the identified network device operating system operation in  
6 preparation for invoking a function that can perform one or more tasks  
7 associated with the operation; and  
8 invoking the function defined by the network device operating system component that  
9 can perform the one or more tasks associated with the operation.

1 18. A computer-readable medium as recited in Claim 14, wherein the XML document  
2 includes data associated with the network device operating system operation, and  
3 wherein the step of processing the identified network device operating system  
4 operation in preparation for invoking the function comprises:

5 validating data associated with the network device operating system operation; and  
6 mapping the data to one or more data structures that are associated with the function.

1 19. A computer-readable medium as recited in Claim 14, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:  
4 receiving, in the XML document, a query from a network management application  
5 about the several network device operation system components that are  
6 supported; and  
7 providing a response to the network management application that identifies one or  
8 more of the several network device operation system components that are  
9 supported.

1 20. A computer-readable medium as recited in Claim 14, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:  
4 receiving, in the XML document, a query from a network management application  
5 about one or more of several objects that are supported by the several  
6 components; and  
7 providing a response to the network management application that identifies one or  
8 more of the objects that are supported.

1 21. A computer-readable medium as recited in Claim 20, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:

4 receiving, in the XML document, receiving a query from a network management  
5 application about one or more of several methods that are supported by the  
6 objects; and  
7 providing a response to the network management application that identifies one or  
8 more of the methods that are supported.

1 22. A computer-readable medium as recited in Claim 20, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:  
4 receiving, in the XML document, a query from a network management application  
5 about one or more of several attributes that are supported by the methods; and  
6 providing a response to the network management application that identifies one or  
7 more of the attributes that are supported.

1 23. A computer-readable medium as recited in Claim 14, further comprising instructions,  
2 which when executed by the one or more processors, cause the one or more  
3 processors to perform the steps of:  
4 receiving, in the XML document, an invocation by a network management  
5 application of one or more of several methods that are implemented by one or  
6 more objects of the several components; and  
7 invoking the one or more methods through a callback to one or more of the  
8 components.

1 24. An apparatus for processing a network device operating system operation,  
2 comprising:



3 means for receiving the network device operating system operation and associated  
4 data within an Extensible Markup Language (XML) document;  
5 means for parsing the XML document to identify the network device operating  
6 system operation;  
7 means for selecting one of several network device operating system components that  
8 can process the identified network device operating system operation;  
9 means for preparing the associated data for use by the selected one of several network  
10 device operating system components; and  
11 means for providing the identified network device operating system operation and the  
12 prepared data in a callback to the selected one of the several network device  
13 operating system components.

1 25. The apparatus of Claim 24, further comprising:  
2 means for receiving responsive data from the selected one of the several network  
3 device operating system components;  
4 means for creating a responsive XML document that contains the responsive data in  
5 XML format; and  
6 means for sending the responsive XML document to a network management  
7 application.

1 26. The apparatus of Claim 1, wherein the XML document is received within a transport  
2 protocol message that conforms to one of several transport protocols, and further  
3 comprising means for extracting the XML document from the transport protocol  
4 message.

1 27. The apparatus of Claim 1, further comprising:

2 means for processing the identified network device operating system operation in  
3 preparation for invoking a function that can perform one or more tasks  
4 associated with the operation; and  
5 means for invoking the function defined by the network device operating system  
6 component that can perform the one or more tasks associated with the  
7 operation.

1 28. The apparatus of Claim 1, wherein the XML document includes data associated with  
2 the network device operating system operation, and wherein the means for processing  
3 the identified network device operating system operation in preparation for invoking  
4 the function comprises:  
5 means for validating data associated with the network device operating system  
6 operation; and  
7 means for mapping the data to one or more data structures that are associated with the  
8 function.

1 29. The apparatus of Claim 1, further comprising:  
2 means for receiving, in the XML document, a query from a network management  
3 application about the several network device operation system components  
4 that are supported; and  
5 means for providing a response to the network management application that identifies  
6 one or more of the several network device operation system components that  
7 are supported.

1 30. The apparatus of Claim 1, further comprising:

2 means for receiving, in the XML document, a query from a network management  
3 application about one or more of several objects that are supported by the  
4 several components; and  
5 means for providing a response to the network management application that identifies  
6 one or more of the objects that are supported.

1 31. The apparatus of Claim 7, further comprising the steps of:

2 means for receiving, in the XML document, receiving a query from a network  
3 management application about one or more of several methods that are  
4 supported by the objects; and  
5 means for providing a response to the network management application that identifies  
6 one or more of the methods that are supported.

1 32. The apparatus of Claim 7, further comprising the steps of:

2 means for receiving, in the XML document, a query from a network management  
3 application about one or more of several attributes that are supported by the  
4 methods; and  
5 means for providing a response to the network management application that identifies  
6 one or more of the attributes that are supported.

1 33. The apparatus of Claim 1, further comprising:

2 means for receiving, in the XML document, an invocation by a network management  
3 application of one or more of several methods that are implemented by one or  
4 more objects of the several components; and  
5 means for invoking the one or more methods through a callback to one or more of the  
6 components.

1     34.     An apparatus for processing a network device operating system operation,  
2             comprising:  
3             a network interface that is coupled to a data network for receiving one or more packet  
4                     flows therefrom;  
5             a processor; and  
6             one or more stored sequences of instructions which, when executed by the processor,  
7                     cause the processor to perform the steps of:  
8                     receiving the network device operating system operation and associated data  
9                             within an Extensible Markup Language (XML) document;  
10                     parsing the XML document to identify the network device operating system  
11                             operation;  
12                     selecting one of several network device operating system components that can  
13                             process the identified network device operating system operation;  
14                     preparing the associated data for use by the selected one of several network  
15                             device operating system components; and  
16                     providing the identified network device operating system operation and the  
17                             prepared data in a callback to the selected one of the several network  
18                             device operating system components.

1     35.     The apparatus of Claim 34, further comprising instructions, which when executed by  
2             the processor, cause the processor to perform the steps of:  
3             receiving responsive data from the selected one of the several network device  
4                     operating system components;  
5             creating a responsive XML document that contains the responsive data in XML  
6                     format; and

7 sending the responsive XML document to a network management application.

1 36. The apparatus of Claim 34, wherein the XML document is received within a transport  
2 protocol message that conforms to one of several transport protocols, and further  
3 comprising instructions, which when executed by the processor, cause the processor  
4 to perform the step of extracting the XML document from the transport protocol  
5 message.

1 37. The apparatus of Claim 34, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:  
3 at the selected one of the several network device operating system components,  
4 processing the identified network device operating system operation in  
5 preparation for invoking a function that can perform one or more tasks  
6 associated with the operation; and  
7 invoking the function defined by the network device operating system component that  
8 can perform the one or more tasks associated with the operation.

1 38. The apparatus of Claim 34, wherein the XML document includes data associated with  
2 the network device operating system operation, and wherein the step of processing  
3 the identified network device operating system operation in preparation for invoking  
4 the function comprises:  
5 validating data associated with the network device operating system operation; and  
6 mapping the data to one or more data structures that are associated with the function.

1 39. The apparatus of Claim 34, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:

3 receiving, in the XML document, a query from a network management application  
4 about the several network device operation system components that are  
5 supported; and  
6 providing a response to the network management application that identifies one or  
7 more of the several network device operation system components that are  
8 supported.

1 40. The apparatus of Claim 34, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:  
3 receiving, in the XML document, a query from a network management application  
4 about one or more of several objects that are supported by the several  
5 components; and  
6 providing a response to the network management application that identifies one or  
7 more of the objects that are supported.

1 41. The apparatus of Claim 40, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:  
3 receiving, in the XML document, receiving a query from a network management  
4 application about one or more of several methods that are supported by the  
5 objects; and  
6 providing a response to the network management application that identifies one or  
7 more of the methods that are supported.

1 42. The apparatus of Claim 40, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:

3 receiving, in the XML document, a query from a network management application  
4 about one or more of several attributes that are supported by the methods; and  
5 providing a response to the network management application that identifies one or  
6 more of the attributes that are supported.

1 43. The apparatus of Claim 34, further comprising instructions, which when executed by  
2 the processor, cause the processor to perform the steps of:  
3 receiving, in the XML document, an invocation by a network management  
4 application of one or more of several methods that are implemented by one or  
5 more objects of the several components; and  
6 invoking the one or more methods through a callback to one or more of the  
7 components.